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Irregular Growth of Outplanted Red Pine
II. The Influence of Handling and Planting on First-Year Performance

by

G. Pierpoint, J.M. Paterson, J.G. Boufford and C. Glerum

Unsatisfactory performance of freshly lifted red pine (*Pinus resinosa* Ait.) seedlings outplanted in the field during recent years has been described by Glerum et al (1977). A reduction in survival occurs. Abnormal development of the terminal leader is observed on some surviving seedlings. This growth irregularity may range from a non- or barely-elongated "silver bud" to an elongated leader with deficient leaf development.

The cause of the problem has not been obvious. Glerum et al (ibid) found no definite herbicide influence, although they did not reject herbicides completely as a possible factor.

The study reported herein was designed to test the performance of regular 3+0 red pine nursery stock when handled from the nursery and planted in the field with considerable care. A comparison was made with the performance of similar stock handled and planted during normal district operations. This note reports first-year results.

Procedures

During spring, 1976, planting was conducted early in the season and again some two weeks later in six districts using seedling stock from three nurseries, as follows: Kemptville nursery stock in Algonquin Park and Cornwall districts, Midhurst nursery stock in Blind River and Huronia districts, Orono nursery stock in Lindsay and Tweed districts. The season's weather was generally favourable.

The planting sites were chosen, in cooperation with district staff, from those scheduled for 1976 planting in the normal management program of the districts. At each site, six 100-tree plots were laid out, scattered either individually or as pairs joined along one boundary. Three of the individual plots were allocated randomly to be planted carefully by the Forest Research Branch crew; the other three were planted by the district crew in the normal course of the operational planting. Similarly in each

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joined pair, one plot was randomly allocated to the research planting crew and the other was planted by the district crew.

At each site, identical nursery stock was planted by the two crews. Duplicate bags of this identical stock were marked at the nurseries. The district bag was handled by the district staff in their normal way along with the remainder of their planting stock. The research bag was handled with particular speed and care by the research crew. Planting was conducted by the two crews on the same day or within 24 hours of each other, except for the Cornwall early planting. Here, logistical and weather problems resulted in the district plots being planted considerably later than the research plots. This precluded a valid comparison because the planting conditions were quite different. Our results are thus based on eleven tests.

The research crew scalped each planting spot, if the area had not been previously site prepared by the district, and planted carefully by the hole or wedge method, using two-man teams. The district methods varied from machine-planting to hand-planting, with and without site preparation. No chemical treatments were used on any of the plots.

A few plots received slightly more or slightly less than the 100 trees designated for planting. The data analysis of the "100-tree" plots allowed for this. The research crew planted 3 314 trees while the district crew planted 3 323 trees - a total of 6 637 in the 66 plots.

In late 1976, all trees were measured and classified by a two-man research crew to provide data on survival, 1975 height growth (last year in nursery), 1976 leader growth and the quality of the 1976 leader. The quality classes were:

1 - GOOD. Leader showed normal development with needles of good length along most of the leader.

2 - SLIGHTLY ABNORMAL. Needles were shorter than normal and/or more than one-third of the leader was bare.

3 - STRONGLY ABNORMAL. No 1976 needle development; or "silver bud"; or dead bud.

4 - DEAD. Entire tree dead.

The percent survival data from research and district plantings were compared by an analysis of variance of plot values, after square root transformation. The 1976 height growth data from research and district plantings were compared by an analysis of covariance of plot means, to allow for any influence that the 1975 height growth in the nursery (thus seedling size) might have had on the 1976 growth.

Results and Discussion

The results are presented in Table 1. Survival percent values show at least a reasonable success in every planting, with many being 90% or better. District survival values were significantly lower than research survival

TABLE 1 Influence of handling and planting on survival, growth and quality class of outplanted red pine[a]

Planting code[b]	Survival %	F	Height growth Total[c] cm	Mean cm	F	Quality class 1 %	2 %	3 %	4 %
AKDE	90	7.2	1925	7.2	67.9***	7	69	13	10
AKRE	96		2840	9.8		30	58	8	4
AKDL	84	78.2***	1193	4.8	138.1***	0	73	11	16
AKRL	95		2086	7.4		21	72	2	5
BMDE	74	54.5***	944	4.2	344.3***	3	65	7	26
BMRE	98		2266	7.7		52	46	1	2
BMDL	75	3.3	850	3.8	300.6***	5	53	17	25
BMRL	99		2278	7.7		40	54	4	1
CKDL	88	0.8	1802	6.8	127.3***	9	73	6	12
CKRL	84		2444	9.7		62	22	1	16
HMDE	85	31.2**	1524	6.0	80.0***	19	61	5	15
HMRE	98		2529	8.6		60	36	2	2
HMDL	84	11.5*	1192	4.7	251.2***	11	58	16	16
HMRL	99		2430	8.2		56	42	1	1
LODE	95	2.3	2313	8.1	4.2*	20	69	6	5
LORE	97		2675	9.2		17	77	3	3
LODL	99	1.8	2628	8.9	5.9*	15	81	3	1
LORL	96		2363	8.2		22	68	5	4
TODE	85	1.3	999	3.9	73.6***	9	40	36	15
TORE	90		1774	6.5		22	53	15	10
TODL	76	13.4*	1010	4.5	108.0***	1	46	28	24
TORL	89		2046	7.6		9	71	9	11

[a] Values are means of three "100-tree" plots, except column four.

[b] Letters show district, nursery stock, handling and planting crew, planting time:

District		Nursery		Crew		Time	
A	Algonquin Park	M	Midhurst	D	District	E	Early
B	Blind River	O	Orono	R	Research	L	Late
C	Cornwall	K	Kemptville				
H	Huronia						
L	Lindsay						
T	Tweed						

[c] Adjusted for exactly 300 trees.

* Significant at 5% level (Survival F > 7.7, growth F > 3.9)
** " " 1% " (" " > 21.2, " " > 6.7)
*** " " 0.5% " (" " > 31.3, " " > 7.9)

values in five of the eleven comparisons, were non-significantly lower in four comparisons and were non-significantly higher in two comparisons.

Height growth data show a rather more telling picture. In ten of the eleven comparisons, the mean height growth on the research plots was significantly better than that on the district plots, mainly at the 0.5% level. The one remaining planting (Lindsay, late) showed mean height growth significantly lower (5% level) on the research plots than on the district plots. This coincided with slightly poorer survival on the research plots, so that the total height growth of all surviving trees on the research plots was 10% less than on the district plots. In the Cornwall late planting the lower survival of the research-planted trees was outbalanced by the greater mean height growth to give a 36% increase in total height growth. In each of the other nine plantings the greater survival and mean height growth of research trees combined to give total height growth values showing increases ranging from 16% to 168% of the appropriate district value.

More trees were of quality class 1 on the research plots than on the district plots, except in the Lindsay early planting. In some cases the difference in number is striking. Trees of quality class 3 were more numerous in all district plantings, except Lindsay late, than in the research plantings, even where district survival values were significantly lower.

The basic purpose of this study was to shed light on whether or not the quality of the planting stock being shipped from the nurseries was the main factor in the so-called "red pine problem" observed in field plantings. The results suggest strongly that the transporting, handling and planting techniques currently used in normal district operations contribute significantly to a reduced performance of outplanted seedlings. It is realized that each normal district planting operation may involve a million or more seedlings handled during a few, hectic weeks. However, there is obviously room for improvement. The quality class data for the research-planted trees suggest that also nursery stock quality might be improved.

Research and development work is, in fact, being continued on various aspects of seedling production and outplanting, which must be viewed as an integrated system.

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Reference

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